MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

TOTAL HARDNESS PROTOCOL

March 5, 2001

For calculation of those Statewide Water Quality Criteria (SWQC) (cadmium, chromium, copper, lead, nickel, silver and zinc) that are functions of total hardness (APHA, 1998), the Department of Environmental Protection (DEP) will use a total hardness of 20 ppm of calcium carbonate (CaCO3) as a statewide default value. Pursuant to protocol G(2) of a document entitled, *Maine Department of Environmental Protection, Toxicity Program Implementation Protocols*, dated July 1998, a licensee/permittee may submit monitoring results in support of an alternate ambient hardness value.

Where natural total hardness upstream of all known point source and non-point source (caused by human activity) discharges that increase the instream total hardness is different than the statewide default, a licensee/permittee may submit receiving water total hardness data from that upstream location to DEP for consideration of an alternate total hardness to be used in calculation of the SWQC. Such data shall be at least monthly measurements for a period of one year in the receiving water upstream of the discharge or equivalent data as determined by the DEP. All receiving water sampling plans to develop an alternative total hardness for the receiving water must be reviewed and approved in writing by the Department prior to implementation. Data collected prior to March 5, 2001, will be considered on a case by case basis.

DEP will consider all data submitted and select the appropriate hardness value. Frequency, duration, and distribution of hardness values will all be considered in determination of the appropriate value of total hardness. For example, generally the lowest value measured will be used with calculation of acute criteria, but if it appears to be an outlying data point, it may be discarded. Mean or median values will generally be used for calculation of chronic criteria as long as the values are not greatly variable. Where they are, some other value, such as the lower 95^{th} percentile, seasonal value, or other value may be used.

Reference:

APHA, 1998. *Standard Methods for the Examination of Water and Wastewater, 20^{th} Edition*. American Public Health Association, Wash, D.C.

BACKGROUND

Maine adopted the U.S. Environmental Protection Agency's (EPA's) Ambient Water Quality Criteria (AWQC) for toxic pollutants as Statewide Water Quality Criteria (SWQC) by statute [38 MRSA section 420(2)] in 1990 and referenced them in rule (Chapter 530.5 of DEP rules). The criteria for many heavy metals are a function of hardness. As a matter of policy, DEP has used a default value of 20 ppm total hardness in the calculation of the criteria since the criteria were first used in the mid-1980s. The default value was determined from data collected all over Maine over many years. The DEP has offered an option for dischargers to provide adequate data in support of site-specific hardness values to be used as an alternative to the default value. Such evidence had to include at least one measurement per month for a year (or equivalent) of the hardness of the receiving water upstream of the discharge point.

In calendar year 2000, two publicly owned treatment works (POTW's) requested the DEP to use downstream hardness in calculation of AWQC for certain heavy metals, and a number of meetings were held within DEP and with the POTW's. The POTW's then secured a letter from Mr. Charles Delos, of EPA headquarters, dated July 7, 2000, stating that use of downstream hardness was appropriate. However, EPA's July 7, 2000 letter acknowledges that states may have 'their own policies on selecting hardness values'.

It has been noted that DEP's policy for developing site-specific criteria based on calculation of a water effects ratio (WER), as specified in the toxics rule, Chapter 530.5, requires that upstream receiving water be spiked with the effluent at the critical low flow dilution ratio, thereby simulating downstream water quality into which the contaminant of concern is spiked. One view is that this rule is inconsistent with DEP's policy of using upstream hardness to calculate site-specific SWQC. The two evaluations are different however. Recalculation of a SWQC based on an alternate hardness for chemicals one at a time does not integrate the combined effects of all chemicals in the discharge as does the WER approach. For that reason DEP feels the need to be more conservative with recalculation.

Furthermore, EPA's endorsement of use of downstream hardness addresses only water column toxicity. Increased hardness reduces the amount of dissolved metal responsible for toxicity in the water column. However, under different conditions that would likely occur in the stream, the metal would potentially be re-dissolved back into the water column. In addition, total loading of metals to the receiving water system would not be reduced, but in fact be increased. Much of the increased metal would precipitate to the sediments, resulting in an increase in total metal in the sediments. There it would, if high enough, affect benthic organisms. This is all contrary to DEP's goal of reducing the discharge of pollutants where possible for protection and improvement of Maine's waters as required by statute.

EPA acknowledges that sediment contamination may be a problem, and proposes to solve it by developing Sediment Quality Criteria. But EPA has been years developing SQC for some other contaminants. Currently there are none for metals, nor is it likely that EPA will complete development of SQC for metals in the near future. DEP's current policy of allowing use of site-specific hardness instead of the statewide default does not specifically address the sediment issue either. However, it is more conservative than use of downstream hardness and therefore provides some additional protection for sediments.

DEP has adopted this protocol to provide for site specific evaluation of toxicity from metals in a manner that is consistent with federal and state goals for reducing, and ultimately eliminating toxic discharges where possible.